Order this document by MC2833/D

MOTOROLA

MC2833

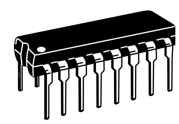
Low Power FM Transmitter System

LOW POWER FM TRANSMITTER SYSTEM

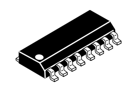
SEMICONDUCTOR TECHNICAL DATA

MC2833 is a one–chip FM transmitter subsystem designed for cordless telephone and FM communication equipment. It includes a microphone amplifier, voltage controlled oscillator and two auxiliary transistors.

- Wide Range of Operating Supply Voltage (2.8–9.0 V)
- Low Drain Current (I_{CC} = 2.9 mA Typ)
- Low Number of External Parts Required
- – 30 dBm Power Output to 60 MHz Using Direct RF Output
- +10 dBm Power Output Attainable Using On–Chip Transistor Amplifiers
- Users Must Comply with Local Regulations on R.F. Transmission (FCC, DOT, P.T.T., etc)

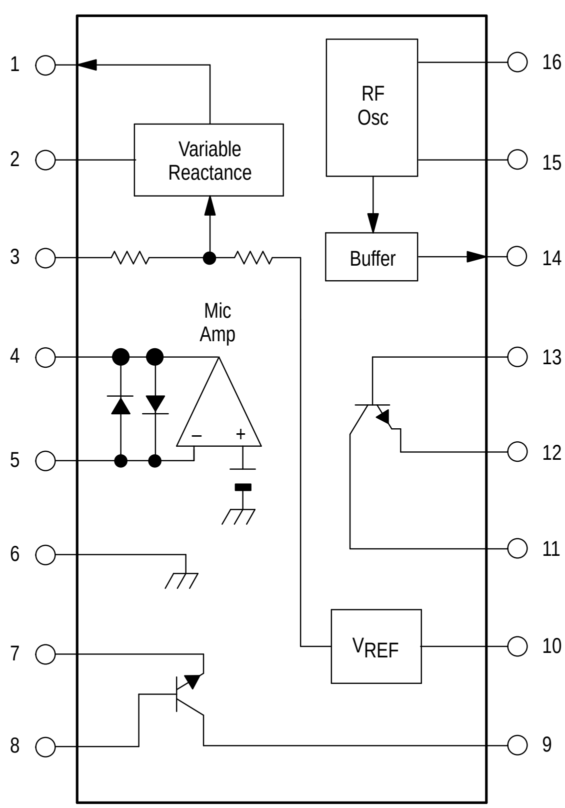


P SUFFIX
PLASTIC PACKAGE
CASE 648

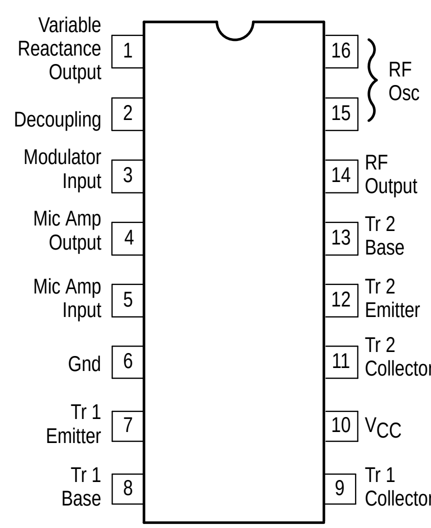


D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO–16)

Representative Block Diagram



PIN CONNECTIONS



ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC2833D	T_A = – 30 to +75°C	SO–16
MC2833P		Plastic DIP

MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	10 (max)	V
Operating Supply Voltage Range	V_{CC}	2.8–9.0	V
Junction Temperature	T_J	+ 150	°C
Operating Ambient Temperature	T_A	– 30 to + 75	°C
Storage Temperature Range	T_{stg}	– 65 to + 150	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 4.0 V, T_A = 25°C, unless otherwise noted)

Characteristics	Symbol	Pin	Min	Typ	Max	Unit
Drain Current (No input signal)	I_{CC}	10	1.7	2.9	4.3	mA
FM MODULATOR						
Output RF Voltage (f_o = 16.6 MHz)	V_{out} RF	14	60	90	130	mVrms
Output DC Voltage (No input signal)	Vdc	14	2.2	2.5	2.8	V
Modulation Sensitivity (f_o = 16.6 MHz) (V_{in} = 0.8 V to 1.2 V)	SEN	3 14	7.0 –	10 –	15 –	Hz/mVdc
Maximum Deviation (f_o = 16.6 MHz) (V_{in} = 0 V to 2.0 V)	Fdev	3 14	3.0 –	5.0 –	10 –	kHz
MIC AMPLIFIER						
Closed Loop Voltage Gain (V_{in} = 3.0 mVrms) (f_{in} = 1.0 kHz)	A_V	4 5	27 –	30 –	33 –	dB
Output DC Voltage (No input signal)	V_{out} dc	4	1.1	1.4	1.7	V
Output Swing Voltage (V_{in} = 30 mVrms) (f_{in} = 1.0 kHz)	V_{out} p–p	4	0.8	1.2	1.6	Vp–p
Total Harmonic Distortion (V_{in} = 3.0 mVrms) (f_{in} = 1.0 kHz)	THD	4	–	0.15	2.0	%

AUXILIARY TRANSISTOR STATIC CHARACTERISTICS

Characteristics	Symbol	Min	Typ	Max	Unit
Collector Base Breakdown Voltage (I_C = 5.0 µA)	$V_{(BR)CBO}$	15	45	–	V
Collector Emitter Breakdown Voltage (I_C = 200 µA)	$V_{(BR)CEO}$	10	15	–	V
Collector Substrate Breakdown Voltage (I_C = 50 µA)	$V_{(BR)CSO}$	–	70	–	V
Emitter Base Breakdown Voltage (I_E = 50 µA)	$V_{(BR)EBO}$	–	6.2	–	V
Collector Base Cut Off Current (V_{CB} = 10 V) (I_E = 0)	I_{CBO}	–	–	200	nA
DC Current Gain (I_C = 3.0 mA) (V_{CE} = 3.0 V)	h_{FE}	40	150	–	–

AUXILIARY TRANSISTOR DYNAMIC CHARACTERISTICS

Characteristics	Symbol	Min	Typ	Max	Unit
Current Gain Bandwidth Product (V_{CE} = 3.0 V) (I_C = 3.0 mA)	f_T	–	500	–	MHz
Collector Base Capacitance (V_{CE} = 3.0 V) (I_C = 0)	C_{CB}	–	2.0	–	pF
Collector Substrate Capacitance (V_{CS} = 3.0 V) (I_C = 0)	C_{CS}	–	3.3	–	pF

Figure 1. Test Circuit

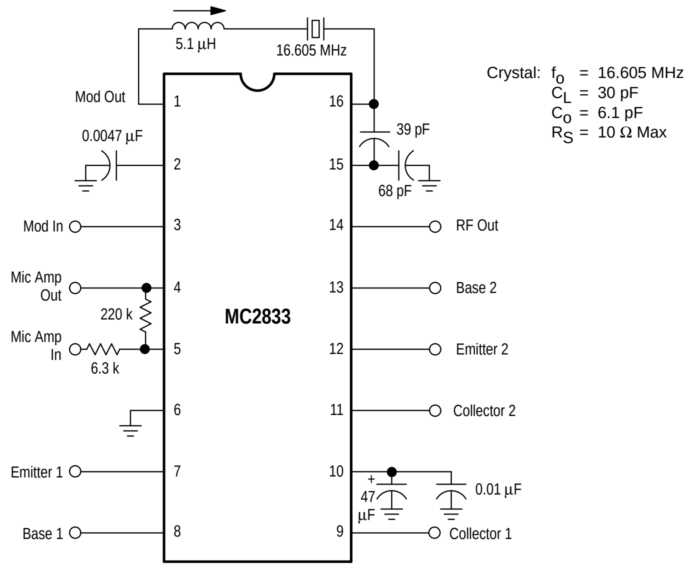
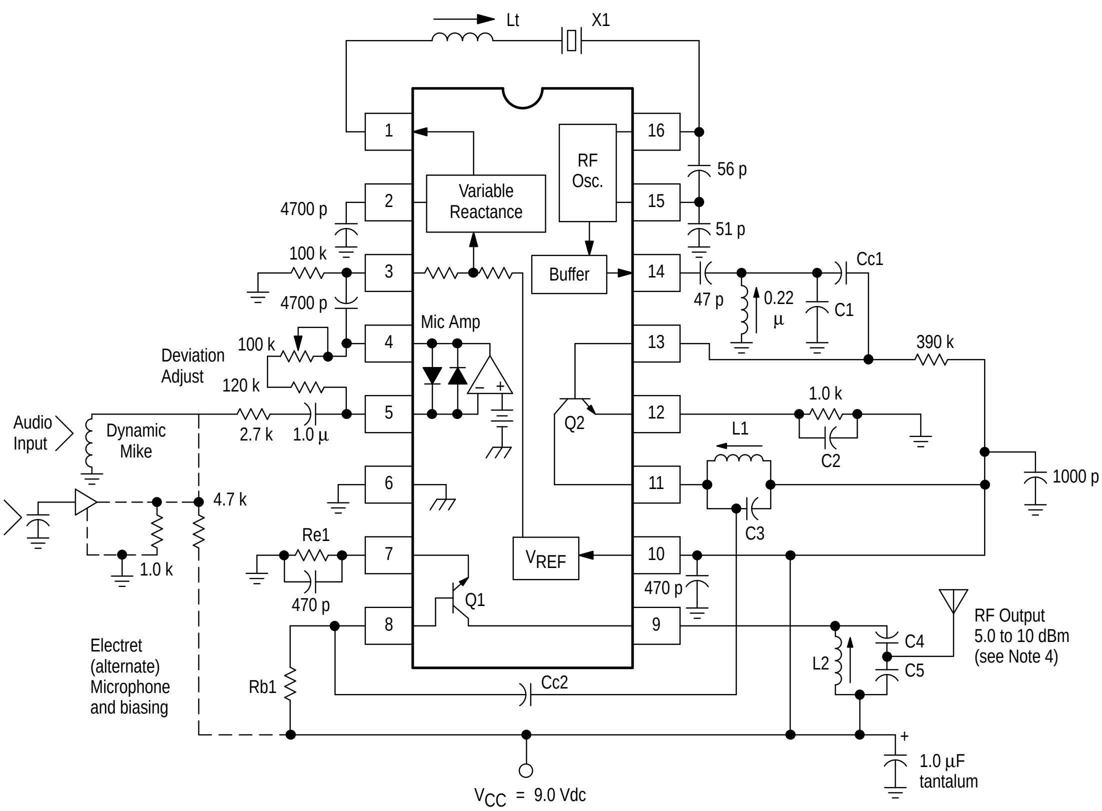


Figure 2. Single Chip VHF Narrowband FM Transmitter



NOTES:

1. Components versus output frequency:

Output RF	X1 (MHz)	Lt (µH)	L1 (µH)	L2 (µH)	Re1	Rb1	Cc1	Cc2	C1	C2	C3	C4	C5
50 MHz	16.6667	3.3–4.7	0.22	0.22	330	390 k	33 p	33 p	33 p	470 p	33 p	47 p	220 p
76 MHz	12.6000	5.1	0.22	0.22	150	300 k	68 p	10 p	68 p	470 p	12 p	20 p	120 p
144 MHz	12	5.6	0.15	0.10	150	220 k	47 p	10 p	68 p	1000 p	18 p	12 p	33 p

2. Crystal X1 is fundamental mode, calibrated for parallel resonance with a 32 pF load. The final output frequency is generated by frequency multiplication within the MC2833 IC. The RF output buffer (Pin 14) and Q2 transistor are used as a frequency tripler and doubler, respectively, in the 76 and 144 MHz transmitters. The Q1 output transistor is a linear amplifier in the 49.7 MHz and 76 MHz transmitters, and a frequency doubler in the 144 MHz transmitter.
3. All coils used are 7 mm shielded inductors, CoilCraft series M1175A, M1282A–M1289A, M1312A or equivalent.
4. Power output is ≈ + 10 dBm for 50 MHz and 76 MHz transmitters, and ≈ + 5.0 dBm for the 144 MHz transmitter at V_{CC} = 8.0 V. Power output drops with lower V_{CC}.
5. All capacitors in microfarads, inductors in Henries and resistors in Ohms unless otherwise specified.
6. Other frequency combinations may be set–up by simple scaling of the 3 examples shown.

Figure 3. Buffer/Multiplier (x3, Pin 14)
(16 MHz Fundamental)

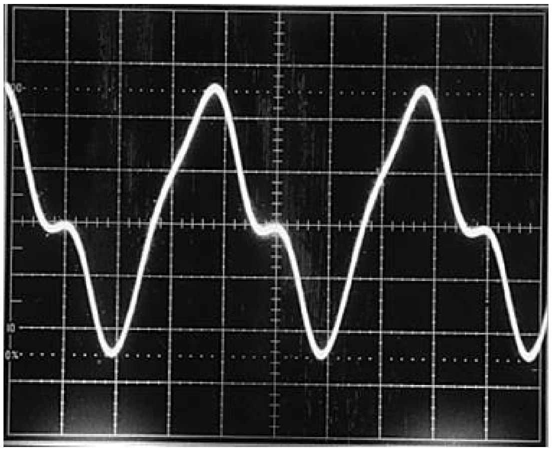


Figure 4. Input to Doubler (Pin 13)
(50 MHz x 3 Component)

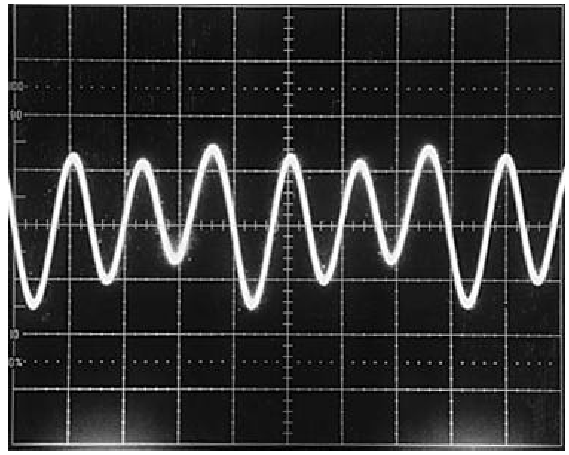


Figure 5. Doubler Output 76 MHz (Pin 11)

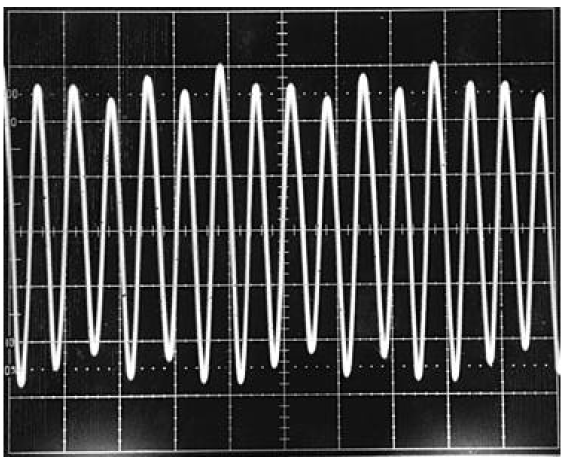


Figure 6. Spectrum

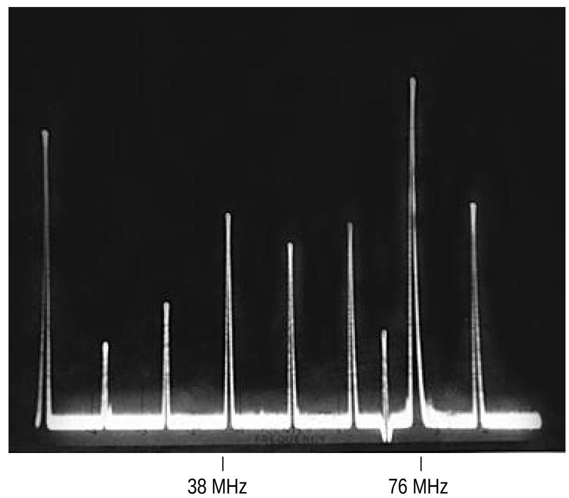


Figure 7. Output Spectrum (50 MHz)

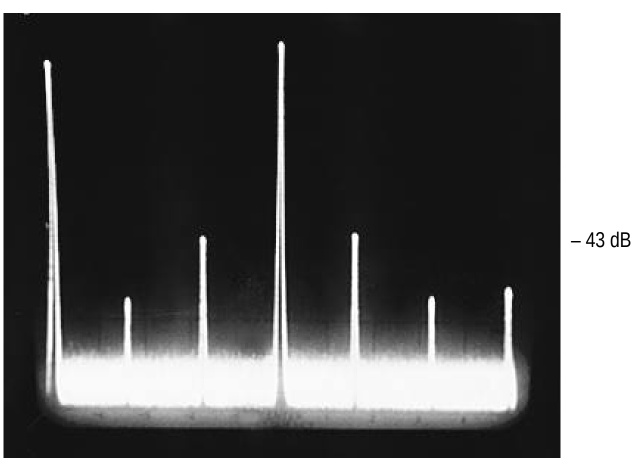


Figure 8. Modulation Spectrum
(1.0 kHz Showing Carrier Null)

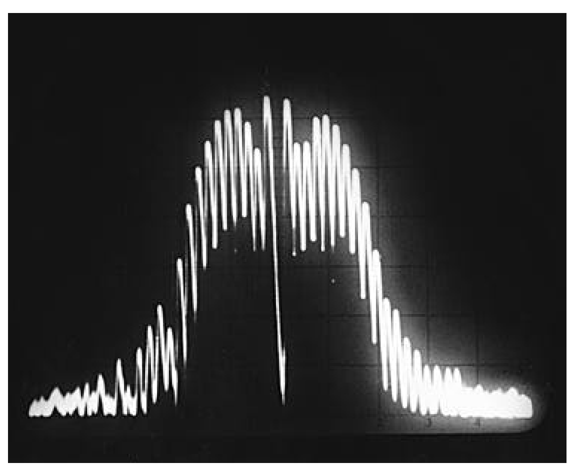


Figure 9. 144 MHz/x12 Multiplier

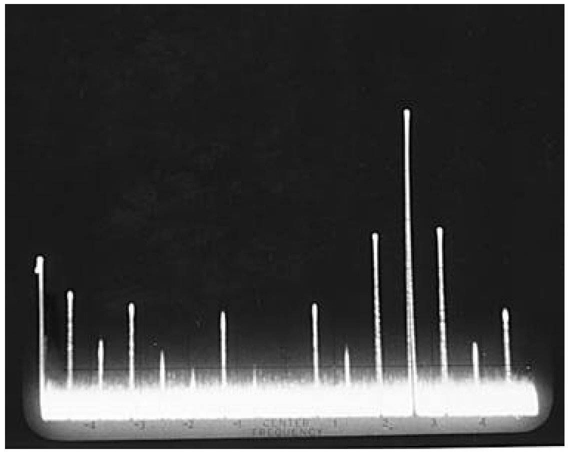


Figure 10. Circuit Side View

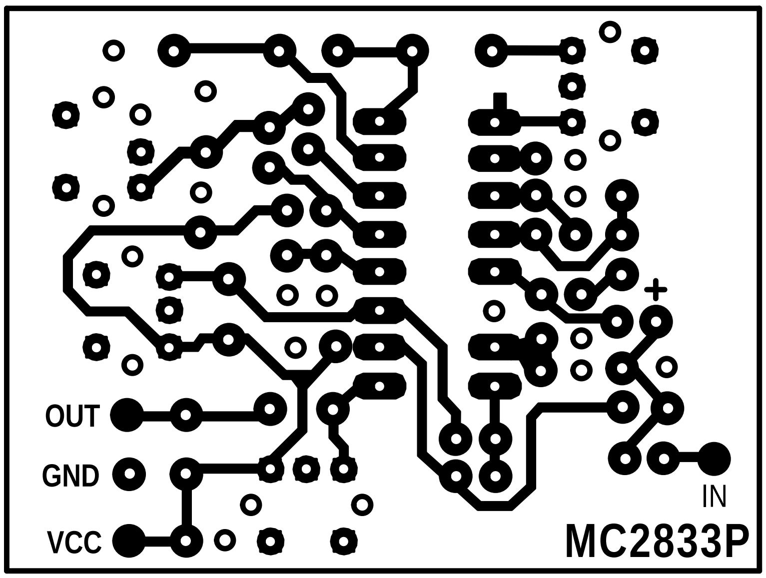


Figure 11. Ground Plane on Component Side

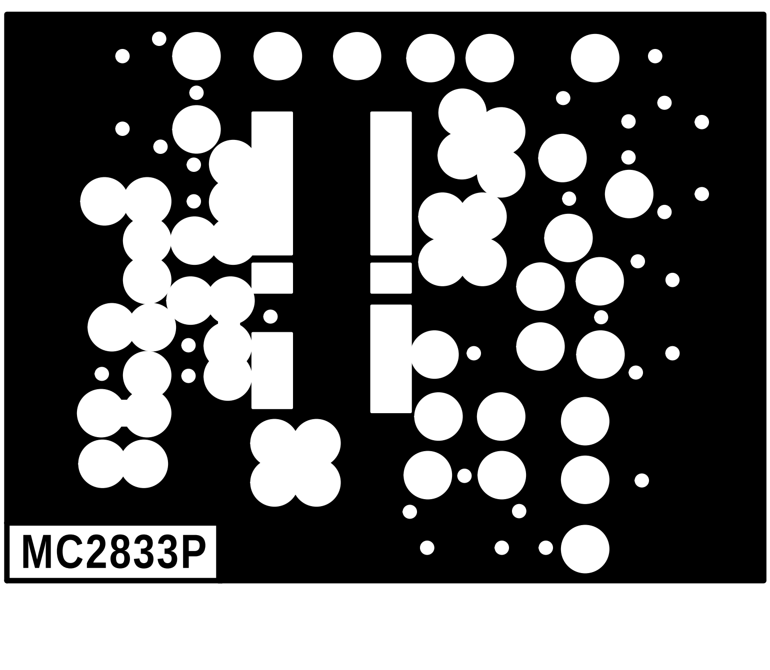
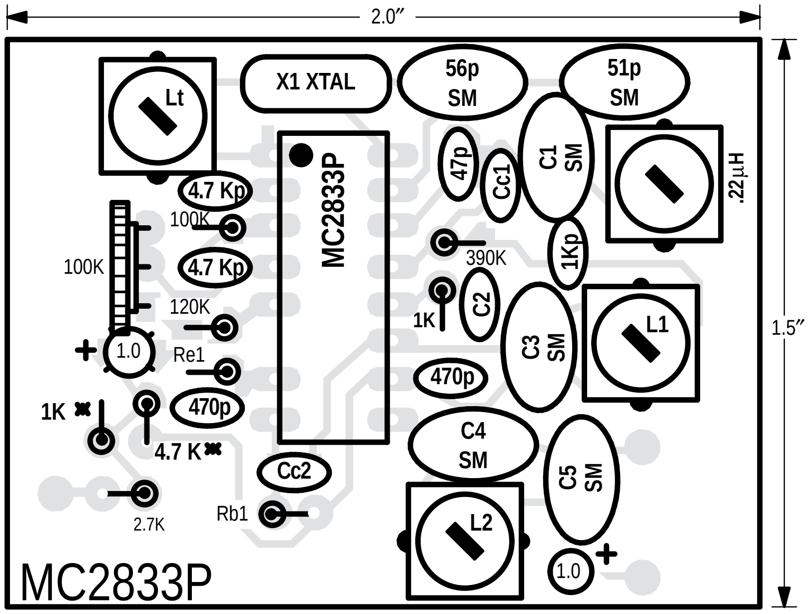
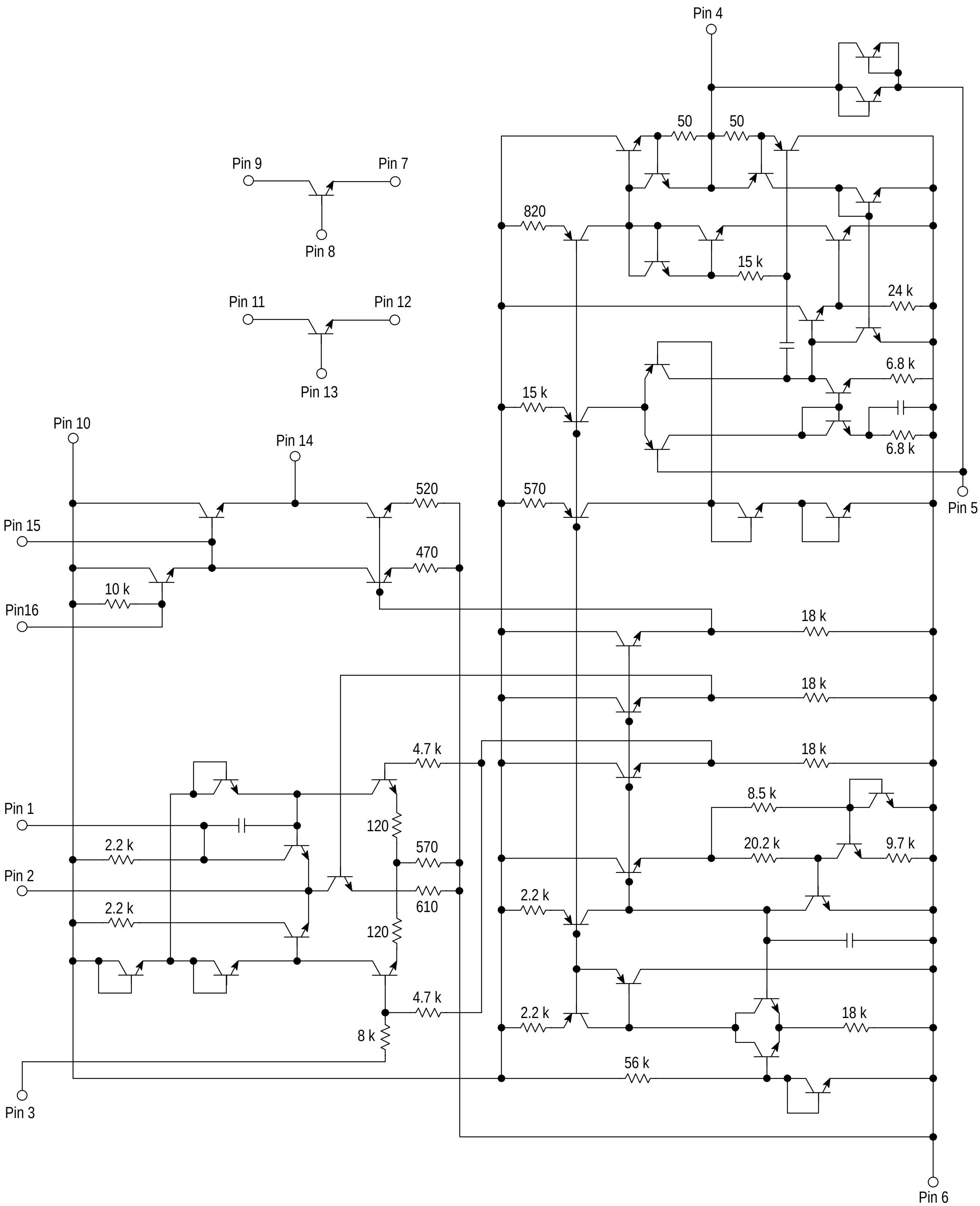


Figure 12. Component View



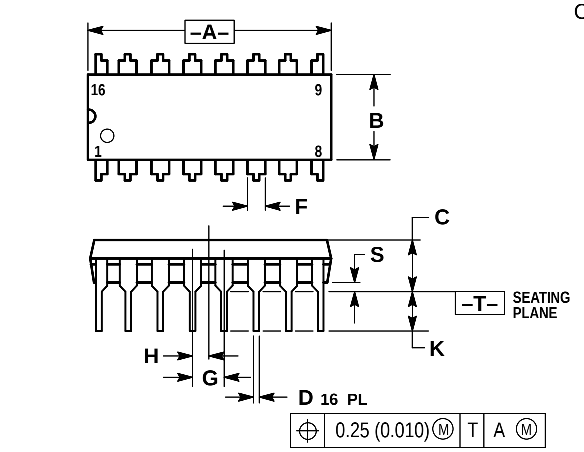
NOTES:
- Positive artwork provided.
- Drill holes must be plated to ensure making all ground (V_{EE}) connections!
- Resistors labelled * are used for biasing of electret microphone if used.
- Capacitors labelled ″SM″ are silver mica.
- Final board size 1.5″ × 2.0″.

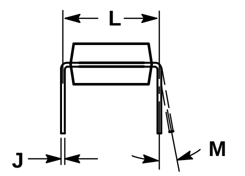
Figure 13. Circuit Schematic



OUTLINE DIMENSIONS

P SUFFIX
PLASTIC PACKAGE
CASE 648–08
ISSUE R

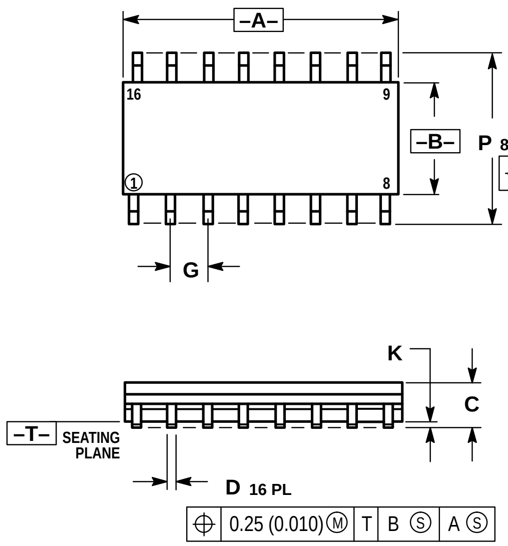


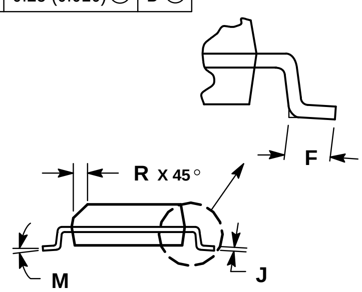


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

D SUFFIX
PLASTIC PACKAGE
CASE 751B–05
(SO–16)
ISSUE J





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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